FossilExit:

30-Member Research Group on Transformation from Fossil to 100% Renewable Energy Systems

The focus of teaching and research of the research group FossilExit is on the transformation from fossil to 100% renewable energy systems in order to limit the increase of the global average temperature to a maximum of 1.5°C.

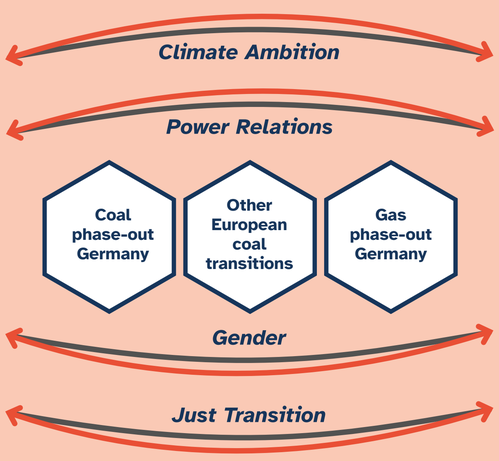
The research and expertise of the interdisciplinary 30-member research group of Prof. Oei stretches from

- modeling techno-economic challenges to integrate 100% renewable energy in the electricity, heat and transport sectors, to other more
- socio-political challenges of the associated structural changes and the
- political economy of a fossil fuel phase-out including gender aspects in Germany and around the world.

Interdisciplinary *METHODS* to answer various overlapping research questions

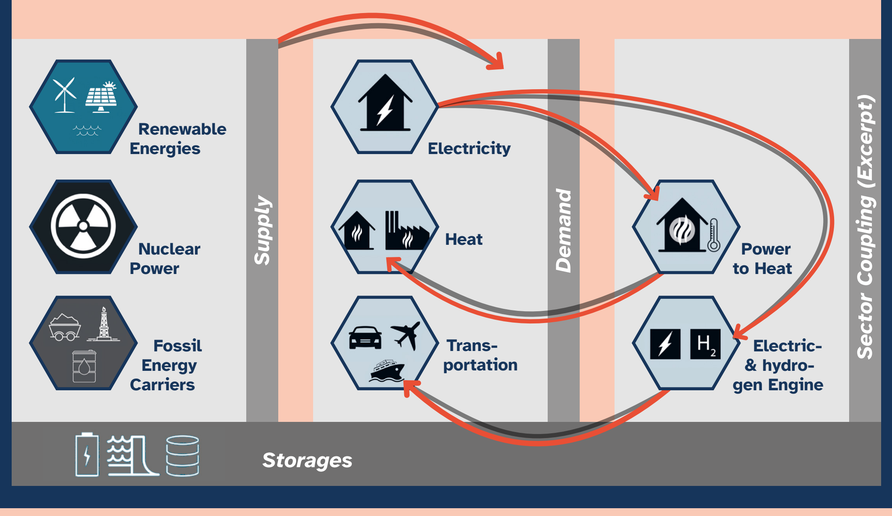
Theoretical & methodological approaches and research dimensions

Qualitative Methods:
- Expert Interviews
- Document Analysis
- Discourse Analysis
- Systematic Literature Analysis
- Focus Groups



Theory:
- Sustainability Transitions
- Feminist Theory
- Political Economy

The Open Source Energy System Model GENeSYS-MOD

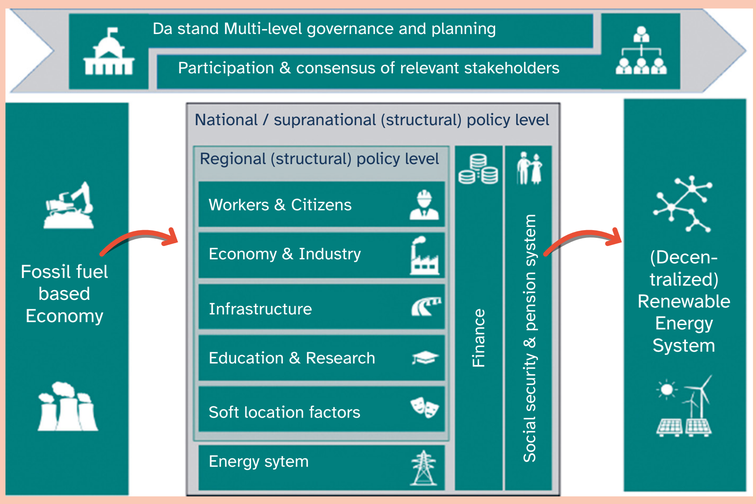


Examining socially just, ecological reasonable and economically justifiable global coal phase out scenarios

We assess prospects of future coal production and exports by modelling international coal markets, trade flows, investments and production under different demand scenarios.

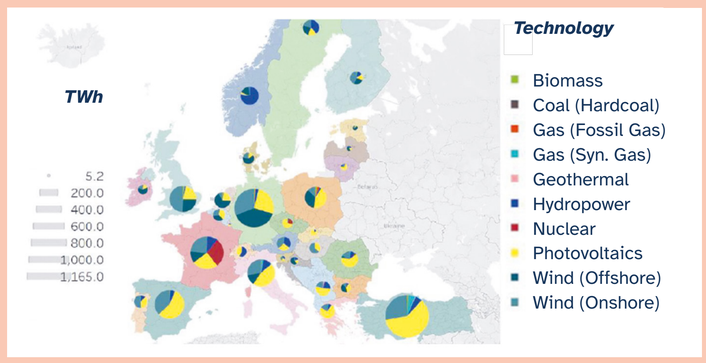
RESULTS: How to transition from coal to renewables in Germany and globally

The research addresses the question of how the production and consumption of coal and other fossil fuels can be reduced through appropriate energy, climate and cohesion policies in order to mitigate the consequences of the climate crisis.

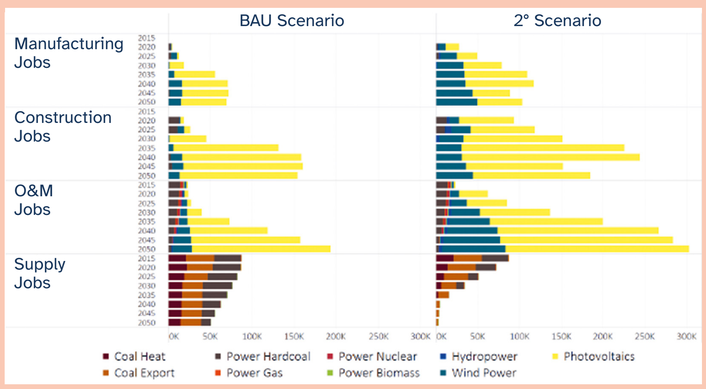


We focus on policy-relevant research on socially just and more ambitious phase-out options for coal and other fossil fuels, examining the power and influence of different actors, gender aspects, and political contexts.

- **Gas is not a transition fuel and should be phased out as quickly as possible**
- **So-called soft location factors (e.g. education, art, participation of civil society actors) should be given greater consideration in structural change processes**
- **In coal regions, most attention is paid to the needs of the (mostly male) miners. The (different) needs of all people in the regions should be taken into account.**

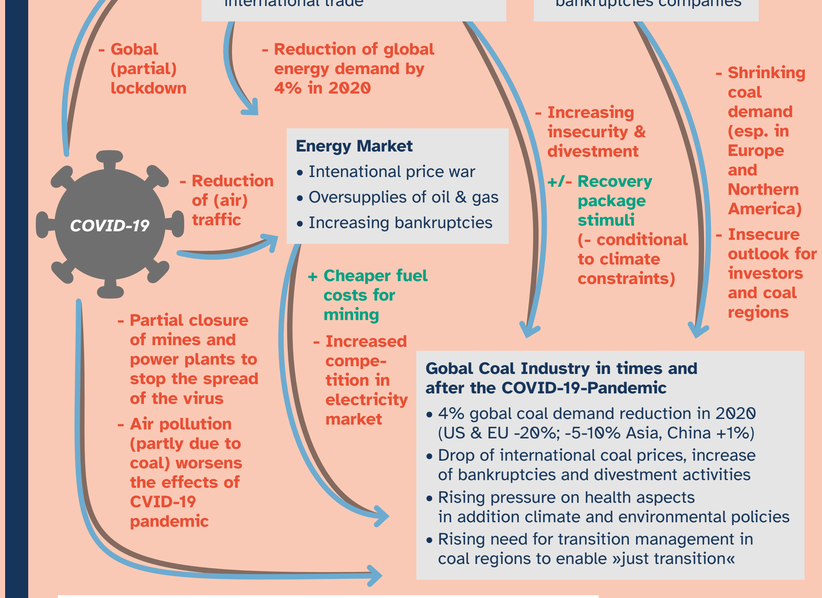


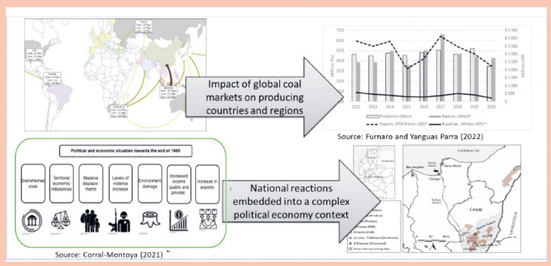
We model the entire energy system taking into consideration different climate policies (e.g. the electricity producion in Europe in the year 2050 assuming a »technology friendly« scenario).



Changes of the energy sector will result in regional employment effects (e.g. shifts per job type, year, and fuel in South Africa).

Effects on coal industry
- negative;
+ positive





We aim to provide input to progress the discussion on energy transition in different countries & develop in-depth case studies for the barriers and opportunities of international coal transitions.

Conclusions and Recommendations:

- Different challenges prevail for countries & regions, calling for locally adapted & politically viable solutions.
- Technical solutions are comparably easy & well researched; socio-political aspects need more analysis.
- Crucial to prevent new (stranded) coal or gas investments (plants or mines) in Germany and abroad.
- Progressive coal regions receive the biggest support and have the best chances to diversify and improve.
- Regions ignoring the trend will observe a delayed economic collapse with lower chances for recovery.

Impressions

Presenting our research results at the German coal commission, at demonstrations in front of 50 000 people as well as at scientific forums allowed dissemination and discussions with science, civil society, industry and policy makers in Germany and abroad

Selected academic publications

Hanto et al. (2022): *South Africa's energy transition — Unraveling its political economy.* Energy for Sustainable Development, Volume 69, August 2022, 164-178.

Löffler et al. (2022): *Chances and barriers for Germany's low carbon transition — Quantifying uncertainties in key influential factors Energy, Volume 239, Part A.*

Diluiso et al. (2021): *Coal transitions — part 1: a systematic map and review of case study learnings from regional, national, and local coal phase-out experiences.* in: Environmental Research Letters, 16, 113003.

Hanto et al. (2021): *Effects of Decarbonization on the Energy System and Related Employment Effects in South Africa.* in: Environmental Science & Policy, 124 (October): 73-84.

Walk et al. (2021): *Strengthening Gender Justice in a Just Transition: A Research Agenda Based on a Systematic Map of Gender in Coal Transitions.* in: Energies 14: 5985.

Yanguas Parra et al. (2021): *The death valley of coal — Modelling COVID-19 recovery scenarios for steam coal markets.* in: Applied Energy 288 (April): 116564.

Hainsch et al. (2020): *Emission Pathways Towards a Low-Carbon Energy System for Europe: A Model-Based Analysis of Decarbonization Scenarios.* in: The Energy Journal 42 (5)

Brauers et al . (2020): *Comparing Coal Phase out Pathways: The United Kingdom's and Germany's Diverging Transitions.* in: Environmental Innovation and Societal Transitions 37

Auer, H. et al. (2020): *Development and modelling of different decarbonization scenarios of the European energy system until 2050 as a contribution to achieving the ambitious 1.5 °C climate target* in: Elektrotech. Inftech. 137, 346–358

Brauers et al. (2020): *The Political Economy of Coal in Poland: Drivers and Barriers for a Shift Away from Fossil Fuels* in: Energy Policy 14

Kittel et al. (2020): *Scenarios for Coal Exit in Germany A Model Based Analysis and Implications in the European Context.* in: Energies 13 (8).

Oei et al. (2020): *Coal phase-out in Germany Implications and policies for affected regions.* in: Energy 196

Oei et al. (2020): *Lessons from modeling 100% renewable scenarios using GENeSYS MOD.* in: Economics of Energy & Environmental Policy 9 (1)

Stognief et al. (2019): *Economic Resilience of German Lignite Regions in Transition,* in: Sustainability 2019, 11 (21)

Ruíz et al. (2019): *Solar PV Generation in Colombia — A qualitative and quantitative approach to analyze the potential of solar energy market.* in: Renewable Energy 148, 2020

Oei et al. 2019): *Lessons from Germany's hard coal mining phase-out: policies and transition from 1950 to 2018.* in: Climate Policy

Löffler et al. (2019): *Modeling the low-carbon transition of the European energy system v A quantitative assessment of the stranded assets problem.* in: Energy Strategy Reviews 26, 100422

Gerbaulet et al. (2019): *European electricity sector decarbonization under different levels of foresight.* in: Renewable Energy, 2019, DOI: 10.1016/j.renene.2019.02.099

Burandt et al. (2019): *Decarbonizing China's energy system – Modeling the transformation of the electricity, transportation, heat, and industrial sectors.* in: Applied Energy 255

Bartholdsen et al. (2019): *Pathways for Germany's Low Carbon Energy Transformation Towards 2050.* in: Energies 12(15), 2988

Lawrenz et al. (2018): *Exploring Energy Pathways for the Low-Carbon Transformation in India — A Model Based Analysis.* in: Energies 11 (11), 3001

Oei, P et al. (2018): *Prospects for Steam Coal Exporters in the Era of Climate Policies — The Colombian Case.* in: Climate Policy, DOI: 10.1080/14693062.2018.1449094

Europa-Universität Flensburg
Interdisziplinäres Institut für Umwelt-, Sozial- und Humanwissenschaften
Abteilung Energie- und Umweltmanagement

Account with 300+ follower
linkedin.com/company/fossilexit/

DE Account with 1.500+ follower
twitter.com/FossilExit

EN Account with 1.500+ follower
twitter.com/CoalTransitions

Hosted Research Hub with 170+ publications
coaltransitions.org/

FOSSIL EXIT Research Group

This work is supported by several research grants, e.g. from the European Commission, the German Ministry for Education and Research (BMBF), and the Gesellschaft für Energie und Klimaschutz Schleswig-Holstein GmbH.

Prof. Dr. Pao-Yu Oei (full professor for »Economics of Sustainable Energy Transition«):
pao-yu.oei@uni-flensburg.de

uni-flensburg.de/eum